Political Economy and Tenure of Coaches in Brazilian Soccer*

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Abstract

In this paper we built a model of political economy to explain the tenure of coaches in Brazilian soccer. According to the model, a club's board of directors maximizes its reputation by choosing the *grade* of the technical committee. Then, based on data from the Brazilian National Soccer League, we used coaching continuity as a proxy for the *grade* variable and duration analysis techniques to test the model's propositions. According to the empirical analysis, and in line with the theoretical model, a coach's performance is key to determining his continuity at a club. This model allows us to identify a parameter that gives, literally, the effect of the club's performance upon the supporters' perception about the board's work. This parameter is an important determinant of the stability of a coach in charge of a soccer team.

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“In soccer, the coach is the scapegoat. (...) Therefore, one needs heart, courage and balls to be the Brazilian National Coach, as well as being able to mix and match chance and necessity, technique and destiny, love and hate.”
Roberto DaMatta, “O Técnico e o Futebol”

1. Introduction

Over the last few years, the career of a coach has undergone radical changes. For example, big European soccer clubs have adopted a long-term philosophy, guaranteeing stability for their coaches and their respective committees over several seasons. To cite just a few, Alex Ferguson, has held his position at Manchester United since 1986; Arsène Wenger has been at Arsenal since 1996; in Italy, Carlo Ancelotti was the Milan coach for over five years; whilst in Spain, Frank Rijkaard stayed in charge of Barcelona from 2003 to 2008. Even though these coaches have achieved great success with their clubs, this does not necessarily mean that they have won, year after year, all the competitions in which they have taken part. Manchester United, under Alex Ferguson, has failed to win the Premier League since 2003; and, in the same way, Arsenal has not won the English Premier League since 2004.

The Brazilian “model”, on the other hand, is still based, with few exceptions, on short-term strategies. When a team enters a losing streak, even if it is not particularly long, the first measure adopted by the majority of clubs is to change their coach. Frequently, teams that are competing in the national leagues will change their coach up to three times during the season, which seems positively absurd when compared to the behavior seen in more traditional European competitions. If the coach and his technical team have such importance to a club’s long-term strategy, it would appear to make no sense to replace them with the frequency observed in the Brazilian competitions. Indeed, do large companies substitute their Presidents, Directors and Board members two or three times over a single year? Does it make sense for these companies to change their fundamental parts every time the trimester results are negative or below expectations? According to Koning (2003), for example, *“(...) it is not clear that the results on the field improve after a change of coach, it is likely that the board of a team intervenes for other reasons. It is likely that fan and media pressure are also strong determinants of the tenure of a coach.”*

This paper seeks to rationalize the behavior of Brazilian soccer clubs and understand what factors are at play in determining the high turnover of their technical committees. Bearing this in mind, we built a model of political economy for soccer and, subsequently, using data from the Brazilian National Soccer League and duration analysis techniques, we tested the validity of the main propositions resulting from the model.

In a very brief overview, the model is based on the assumption that a club’s

board of directors seeks to maximize its reputation, which determines either its probability of reelection, or the probability of reelection of the party it supports. This reputation depends, positively, on,

- (i) the perception the club's supporters (and advisors) have of the work carried out by the current board, and,
- (ii) the balance of the club's accounts. Intuitively, if supporters consider that the board has a good (bad) image, its reputation will be better (worse) and, therefore, it will have an increased (decreased) chance of winning the next election.

In the same way, sound financial management sends a positive message to both supporters and advisors, which again increases the chances of reelection.

Bearing in mind the battle for reelection, the board can make use of a political instrument to maximize its reputation: the trust it places in its technical committee. In other words, if we consider the club's roster as a quasi-fixed input during the season, the trust placed in the technical committee becomes the only instrument that the board can use to maximize its reputation (probability of reelection).

First of all, this approach had not been yet considered by the literature on the economics of sports. For example, Dobson and Goddard (2001) state that, typically, the literature views professional clubs as agents that maximize profits or team performance, being subject to a budget constraint.¹ Sloane (1971) is a classic reference with respect to this subject. The author suggests that there are several plausible and easily quantifiable objectives, such as profits, financial health of the league and attendance. In our model, instead, the objective of the club's board of directors is to maximize its reputation which, in turn, positively affects its probability of reelection.

Secondly, it is important to emphasize that the rationality of the model is in accordance with the Brazilian clubs. Differently from the European soccer, the majority of Brazilian first-division clubs can be considered democratic – where the board is regularly elected by the club's associated fans.

In addition, we submitted the theoretical propositions derived from the model to empirical analysis. Specifically, based on data from the Brazilian National Soccer League, we used the retention of coaches as a proxy for the trust that the board attributes to its committee (which is precisely the theoretical model's control variable) and duration analysis techniques to understand which are the main determining factors for the retention of coaches.

Driven by these objectives, the paper is divided into another three sections, in addition to this brief introduction. The second section details and sets the theoretical political economy model. In the third section, we describe the procedures

¹This comment is here thanks to a valuable suggestion made by an anonymous referee.

employed for the empirical analysis and their principal results. The final section consists of a brief conclusion.

2. The Theoretical Model

This section contains a description of the structure of the political economy model. In general terms, we consider that:

- A club's board of directors maximizes the function $R(\cdot)$, called reputation. The board's principal objective is to be reelected and thus, the better its reputation, the greater its chances of reelection – or the victory of the party supported by the current administration;
- The board's reputation is made up of two components. The first is determined by the perception of the supporters regarding the work done by the board (the board's image as seen by the club's supporters, which in turn is a function of the club's performance). The second stems from the board's ability to balance the club's finances. We have assumed that,
 - (i) the board's reputation is dependent on the perception of the club's supporters regarding the work performed by the current board² (a positive perception guarantees the supporters' support, increases the board's reputation and its chances of reelection) and,
 - (ii) an increase to the club's coffers acts as a positive signal from the board to the club's advisors which, in turn, also tend to improve the board's reputation and reduce the appeal of its opposition in the next election. We will refer to these functions as perception and financial balance: $P(\cdot)$ and $E(\cdot)$, respectively;
- The board affects both its image as viewed by the supporters (the perception function) and financial balance (the financial balance function) through the “*grade*” it attributes to the technical committee. This factor could also be interpreted as a campaign by the board in favor (or against) the technical committee. If the club's performance is poor, a campaign against the committee (blaming the poor performance on the coach and his staff) reduces the share of the failure that the supporters attribute to the board. If the club's performance is good, a support campaign gives the board (and its management work) visibility, which also increases the share of success attributed to the club's board. Furthermore, we assume that the League has two periods and that the reputation function, described above, depends on the perception of the supporters and on the club's financial balance in both the first and second periods.³

²The “quality” of the board is, on the other hand, directly measured by the club's performance.

³The first and second periods are merely didactic simplifications. One can, instead, regard them as “ n first games” and subsequent games.

2.1 Basic hypotheses

As previously stated, the club's board seeks to maximize its reputation (probability of reelection) which, in turn, depends on its image (the perception function) as perceived by the club's supporters and on its financial balance (the financial balance function), for both the first and second periods. Mathematically, let us assume that the reputation function can be generally expressed by the following equation:

$$R = r(P_1 + P_2, E_1 + E_2) \quad (1)$$

In this equation, P_1 represents the perception function of the supporters at the end of period t (the board's image at the end of period t) and E_t is the financial balance function, also at the end of period t . As usual, let us assume that $R(\cdot)$ is concave and that

- (i) $r'_1(\cdot) > 0$ and,
- (ii) $r'_2(\cdot) > 0$.

In addition, the perception function takes the following form:

$$P_t = \theta_t \{\psi_t [D_t(\theta_{t-1}) - D_t^e]\} \quad (2)$$

where: θ_t is the *grade* attributed to the committee, $D_t(\cdot)$ is the club's performance at the end of the t^{th} period⁴ and $\psi_t > 0$ is a parameter that denotes the weight given by the supporters to the loss of performance in the t^{th} period. Alternatively, this parameter can be seen as the weight that the board attributes, in its reputation function, to the supporters' perception (pressure).

As mentioned, and in accordance with this equation, the choice of *grade* alters the positive (negative) perception of the supporters (and advisors) regarding the board's performance. We assume that $\theta_t \geq 0$, which reflects the incapacity of the board to turn a negative perception into a positive one by changing the *grade* of the committee.

It is also worth noting that the *grade* obtained by the end of one period will affect the team's performance over the following period. More specifically, if the board attributes a low (high) *grade* it will generate insecurity (security) in the committee, which could eventually lead to loss (gain) in performance over the following period. Mathematically, $D'(\theta) > 0$ and $D''(\theta) \leq 0$.

The financial balance function will take separable forms at the end of the first and second periods. This differentiation is explained when we consider that coaches only negotiate their salaries at the end of the second period (the end of

⁴The expected performance for each period is set by the board (or supporters) at the beginning of the season.

the League competition). In other words, a good *grade* in the first period will only translate into salary increases after the end of the second period. Thus, we have:

$$E_1 = \bar{M}_1 - M_1, \text{ and} \quad (3)$$

$$E_2 = \bar{M}_2 - M_2(\theta_1 + \theta_2) \quad (4)$$

In other words, for each period, the financial balance function is simply given by the losses between the period's planned expenditure (M_t) and the actual expenditure ($\bar{M}_t$). It should be noted that, as previously mentioned, the committee's contract is renegotiated at the end of the second period and that this negotiation depends on the *grade* obtained by the board over the first and second periods. In effect, it is reasonable to assume that high (low) *grades* increase (decrease) the technical committee's bargaining power for renegotiation, resulting in pay increases (decreases). More than that, an increase in the technical committee's *grade* should be extended to the entire group, or at least to the coach's key players, since coaches with a high *grade* generally have a greater say in demanding the renewal of contract and hiring of some players. As usual, $M'_2(\cdot) > 0$.

2.2 The board's problem

The timing of the model can be summarized as follows:

0. $\bar{M}_1$ and $\bar{M}_2$ are determined;
1. At the end of the first period M_1 and D_1 are observed and θ_1 is chosen by the board;
2. At the end of the second period D_2 is observed and the board chooses θ_2 ; this determines M_2 .

Bearing all this in mind, the reputation function may be determined by simply substituting (2), (3) and (4) into (1):

$$R = r\{\theta_1[\psi_1(D(\theta_0) - D_1^e)] + \theta_2[\psi_2(D(\theta_1) - D_2^e)], (\bar{M}_1 - M_1) + (\bar{M}_2 - M_2(\theta_1 + \theta_2))\} \quad (5)$$

From this perspective, at the end of the first period, $D(\theta_0)$ is already known and $D(\theta_0) = D_1$ is a fixed value. Furthermore, once the board has chosen the *grade* for the first period, it determines the relative performance for the second period, thus being able to "simultaneously" choose the *grade* for the second period, such that the problem can be written as:⁵

⁵Intuitively, if the choice of the *grade* of the first period also determines the relative performance for the second period, the choice of *grade* for the second period at the end of the first is equivalent to the choice of *grade* of the second period once it is over.

$$\max_{\theta_1 \geq 0, \theta_2 \geq 0} r\{\theta_1[\psi_1(D_1 - D_1^e)] + \theta_2[\psi_2(D(\theta_1) - D_2^e)], (\bar{M}_1 - M_1) + (\bar{M}_2 - M_2(\theta_1 + \theta_2))\} \quad (6)$$

Based on problem (6), and supposing an interior solution, we obtain:

$$r'_1 [\psi_1(D_1 - D_1^e) + \psi_2 D'(\theta_1^*) \theta_2^*] - r'_2 (M'_2(\theta_1^* + \theta_2^*)) = 0 \quad (7)$$

$$r'_1 [\psi_2(D(\theta_1^*) - D_2^e)] - r'_2 (M'_2(\theta_1^* + \theta_2^*)) = 0 \quad (8)$$

Proposition 1 *If the club's performance deteriorates, the board will give the technical committee a lower grade.*

Proof Substituting (8) into (7) we obtain the following: $\psi_1(D_1 - D_1^e) + \psi_2 D'(\theta_1^*) \theta_2^* - \psi_2(D(\theta_1^*) - D_2^e) = 0$. Using the implicit function theorem, it is possible to show that: $\frac{\partial \theta_1}{\partial (D_1 - D_1^e)} = -\frac{\psi_1}{\psi_2[D''(\theta_1)\theta_2 - D'(\theta_1)]} > 0$ if $D'(\theta_1) > 0$, $D''(\theta_1) \leq 0$, $\theta_2 > 0$ and $\psi_1, \psi_2 > 0$. The same holds true for: $\frac{\partial \theta_2}{\partial (D(\theta_1^*) - D_2^e)}$. ■

Proposition 2 *If the supporters attribute a higher (lower) weight to the team's performance in the first period, actual performances below (above) the expected results will result in lower (higher) grades – an increase in pressure in the first period leads the board to “exaggerate” this period's grade.*

Proof Based on the optimization condition, $\psi_1(D_1 - D_1^e) + \psi_2 D'(\theta_1^*) \theta_2^* - \psi_2(D(\theta_1^*) - D_2^e) = 0$, and using the implicit function theorem it is easy to see that $\frac{\partial \theta_1}{\partial \psi_1} = -\frac{(D_1 - D_1^e)}{[D''(\theta_1)\theta_2 - \psi_2 D'(\theta_1)]} > 0$ if $(D_1 - D_1^e) > 0$ and $\frac{\partial \theta_1}{\partial \psi_1} < 0$ if $(D_1 - D_1^e) < 0$, when $D'(\theta_1) > 0$, $D''(\theta_1) < 0$ and $\theta_2 > 0$, $\psi_2 > 0$. ■

In this way, it is possible to show, starting from a simple structure, that performance is crucial to explain the retention of a coach at a club, as it can kick off a campaign for the dismissal of the club's technical committee. In effect, the board, in its search for reputation, lowers the *grade* (trust) placed in the technical committee every time the observed performance for each period is below expectations – whether it is “pandering” to the supporters or shifting the blame onto the technical committee – even though it is aware that its behavior will have a tendency to negatively affect the club's performance over the following periods (Proposition 1).⁶

⁶Marques and Magalhães (2002) analyzed the determining factors of the retention of Brazil's Finance Ministers. In this case, we believe our theoretical model also serves to explain the decision to replace the Finance Minister. Within our framework, if the performance of the economy is below expectation, the President of the Republic, driven by a desire for reelection (or the victory of his party), will act quickly by replacing the Minister. As with soccer clubs whose performance is below (above) expectation, the decrease (increase) in the trust placed in the Minister acts as a

The reaction of the board is also influenced by the weight that the supporters attribute to the club's results. It is possible to say, in this respect, that more impatient supporters who demand results with a greater intensity exercise a decisive influence in determining whether the technical committee will remain or will be replaced. In other words, *ceteris paribus*, teams in which the pressure from supporters is greater tend to set lower *grades* for their coaches when the club's relative performance is poorer.

Furthermore, it is interesting to note that this parameter, ψ_t , is the result of:

- (i) the size and organization of the supporters as a group, and
- (ii) other cultural factors.

From this perspective, we conclude that, to some degree, larger and better organized groups of supporters, or supporters that are more fanatical about soccer due to cultural reasons, will exercise greater pressure on the board and that this pressure will cause, in cases in which the team's performance is poor, the immediate dismissal of the coach.

In addition, as discussed previously, ψ_t could simply denote the weight that the club's board attributes to the supporters' perception. The value of this parameter depends, in turn, on the internal political issues at the club such as, for example, the pressure exercised by the opposing parties. In effect, if the board believes that the losses in performance will harm its possibility of reelection, it will react by instantly reducing the trust placed in the committee every time the team's performance becomes relatively poorer. However, the parameter ψ_t – whether from the point of view of the organization or cultural aspects of the supporters, or from the point of view of the club's internal policies – can explain why technical committees can last so long at some clubs, whilst at others their tenure is so brief.⁷

A methodology to test these propositions is outlined in the next section.

3. Empirical Analysis

The theoretical model analyzed until now produces an important result: the coach's *grade* is positively associated with the performance of the club he is at (Proposition 1). In other words, if the club's directors maximize the reputation function – such as the one described above – then we can expect that, on balance, coaches with poorer (better) performances will have lower (higher) *grades*.

In practical terms, starting with the theoretical structure described above and based on data from the Brazilian National Soccer League for 2004, 2005 and 2006, we have used the tenure of the coach in charge of a team as a proxy for the *grade* that the board attributes to the committee. More specifically, we have used the

positive signal for public opinion. It shows service and shifts attention from the problem to the economic team, thus increasing the government's reputation.

⁷For reference on the efficiency of pressure groups, see Becker (1983).

probability that a given coach will keep his job for $n + 1$ fixtures, given that he has been in charge for n fixtures, as an approximation for the *grade* variable.⁸

Intuitively, it makes sense to say that this probability of retention of coaches positively (and strongly) correlates with the trust (*grade*) attributed by the board to its technical committee. Therefore, we have employed duration analysis techniques to assess the determining factors of this variable – see, for example, Kiefer (1988), Greene (2000) and Wooldridge (2002).

Besides, using the same techniques and in line with Proposition 2, we try to identify

- (i) if the pressure on the board is indeed related to the *grade* (tenure) of the coach and
- (ii) the main determinants of the pressure for better performance.

3.1 Description of the data

As previously stated, we have used data from the first division of the Brazilian National Soccer League, more specifically, data from 2004, 2005 and 2006, for the empirical testing of the hypotheses in this paper. The primary source for document research is composed of match summaries made available by the CBF – *Confederação Brasileira de Futebol* (Brazilian Soccer Confederation) on its website: www.cbfnews.uol.com.br.⁹

The scoring system was used for these three seasons, whereby each team plays each other twice, with the winner being the team with the highest score at the end of the final fixture. The winning teams for these three seasons were, Santos Futebol Clube, Sport Club Corinthians Paulista and São Paulo Futebol Clube, coached by Vanderlei Luxemburgo, Antônio Lopes and Muricy Ramalho, respectively.

In order to build the empirical model for the duration analysis, the dependent variable used, for a coach's tenure, was the number of fixtures that a given coach stayed in charge of a given team.¹⁰

The control variables, which seek to explain the retention of a coach in a particular team, are:

- Performance: The number of points (score) accumulated by the team divided by total points disputed under the command of a given coach.

⁸It is important to point out that we will not test the effect of a specific structure of governance on the coach's retention. Given the organizational structure of the Brazilian clubs – which are, in some sense, mainly democratic – we will test if the coach's performance is related to his tenure conditional on the democratic structure. This is different from testing whether the coach's tenure is bigger in a democratic club than in a club with a different structure.

⁹Our sample is composed of 27 professional clubs of which 26 have a democratic structure. See footnote 8.

¹⁰Games in which coaches were fulfilling touchline bans, due to suspension, were included as the team continues to be under their command on a day to day basis and their performance is still judged by the board. In addition, coaches in charge of teams on an interim basis were removed from the sample.

- In progress: A dummy variable that takes the value 1 if a coach takes over a team whilst the League competition is in progress and 0 otherwise.
- Large: A dummy variable that takes the value 1 if the club in question is “large” and 0 otherwise. A club is considered large if it is one of the Big 13.
- Curriculum Vitae: A variable that seeks to capture a given coach’s experience from the titles he has won, taking into account devaluation over time. Its construction only considers titles won for the FIFA Club World Cup (formerly the Intercontinental or Toyota Cup), Copa Libertadores, first division of the Brazilian National Soccer League, Copa do Brasil and whether he has been in charge of the Brazilian national soccer team.¹¹ Each of these was given a weight in order to establish a hierarchy representative of how Brazilian supporters value each title. These weights were: 5 for the FIFA Club World Cup, 4 for the Copa Libertadores, 3 for the Brazilian National Soccer League and 2 for the Copa do Brasil. Coming in second place in these competitions was disregarded with respect to weighting.¹²

In addition to these variables, year dummies and the club’s fixed effects were also taken into consideration.

Some data for the 2004-2006 seasons of the Brazilian National Soccer League are presented in Table 1. In all, there were 160 coaching positions for the three seasons analyzed (59 for the 2004 season, 56 for 2005 and 45 for 2006), with 71 coaches in total. Table 1 summarizes the data for some of these variables.

Table 1
Description of the variables

Variable	No. of observations	Average	Standard deviation	Minimum	Maximum
Tenure	160	16.76	11.14	2	46
Performance	160	0.41	0.13	0	0.68
In progress	160	0.63	0.49	0	1
Large	160	0.46	0.50	0	1
Censored	160	0.36	0.48	0	1

On average, a coach held his position for 16.76 fixtures, with the fastest dismissal occurring after only two fixtures and the longest tenure lasting for 46 fix-

¹¹Looking at how Argentine Daniel Passarella is included in the sample, the titles he won in the Argentine and Mexican Leagues are equivalent to a title won in Brazil. In addition, as he was in charge of the Argentine national team, it was equivalent to being in charge of the Brazilian national team.

¹²The weights given to the titles were depreciated at a rate equal to the inverse of the gap of years since the championship was won. For example, one Copa Libertadores that was won 10 years ago is evaluated in $4 \times (1/10)$.

tures.¹³ The average coach won 41% of the total points disputed. Approximately 60% of the coaches were appointed whilst the League was in progress. Furthermore, 46% of the episodes were observed in clubs that were part of the Big 13.

The censored variable indicates whether a coach was in charge at the end of a League competition. In other words, the value given above shows that approximately 36% of the coaches were employed when the League was over, meaning that their actual tenure could not be verified. In terms of actual figures, this represents a total of 57 “surviving” coaches at the end of each League.

Table 2 shows the ranking of the top five coaches with the best CVs, according to the established criteria, included in the sample for each year. As expected, the highly successful Vanderlei Luxemburgo tops the list for 2004 and 2006, since he was in Spain, at Real Madrid, in 2005.

Table 2
Curriculum Vitae of Brazilian Soccer coaches

Ranking	2006	2005	2004
1st	Vanderlei Luxemburgo	Daniel Passarella	Vanderlei Luxemburgo
2nd	Antônio Lopes	Paulo Autuori	Oswaldo Oliveira
3rd	Valdyr Espinosa	Antônio Lopes	Evaristo de Macedo
4th	Oswaldo de Oliveira	Valdyr Espinosa	Emerson Leão
5th	Emerson Leão	Evaristo de Macedo	Geninho

The histograms below show the distribution of coaches’ tenure, in terms of the number of fixtures, for the whole sample. It should be noted that the greatest concentration of dismissals for the sample occurred near the tenth fixture after a coach takes over. Special note should be taken of the relative asymmetry seen on the right of the histograms, which corresponds to the few examples of coaches with a long tenure.

In the yearly analyses, one can see that the 2004 League demonstrated the greatest asymmetry, with the highest number of early dismissals or short-term tenure. The 2006 League also displays a pattern of early dismissals similar to 2004; however, it is also the season with the highest concentration of coaches with the longest tenure.

¹³These values refer to the 2004 season, which included 24 clubs (the largest number recorded for the analyzed period) and in which three coaches remained in charge from the beginning to the end of the season: Ivo Wortmann at Juventude, Antônio Lopes at Coritiba and Celso Roth at Goiás. In 2005, Muricy Ramalho remained at Internacional for 42 fixtures (as there were 22 clubs in that season). In 2006, Muricy Ramalho, again, but this time at São Paulo, Luiz Menezes (Mano Menezes) at Grêmio, Abel Braga at Internacional, Luiz Saroli (Caio jr.) at Paraná, Vanderlei Luxemburgo at Santos and Renato Portaluppi (Renato Gaúcho) at Vasco da Gama, remained in charge for all 38 fixtures in a League with 20 clubs.

Figure 1
Histograms showing the tenure of coaches at Brazilian clubs
Clockwise: Full sample, League seasons 2004, 2005 and 2006

Table 6.1 (see the Appendix) presents the distribution of the tenure, in number of fixtures, of coaches at Brazilian clubs, showing the frequency and accumulated frequency of the temporal extensions for the analyzed periods. It should be noted that, similarly to the histograms above, the highest concentration occurs between 8 and 13 fixtures, accounting for approximately 30% of the analyzed periods.

3.2 Methodology and results

The econometric instrument used in this paper focuses on the concepts relative to duration analysis. Although the applications still appear to be relatively timid in the economic analysis,¹⁴ nowadays duration studies constitute a mature field of applied statistics, with intense use in fields such as Engineering and Medicine. Below, we present a brief overview of some of the key elements of duration analysis, leaving a more detailed discussion of this methodology for the reference texts, such as Kiefer (1988), Greene (2000) and Wooldridge (2002).

¹⁴For Brazil, we can cite some recent studies that use duration analysis, such as Menezes-Filho and Picchetti (2000), Marques and Magalhães (2002) and Schneider et al. (2002).

Duration analysis deals with the study of the random variable T , denoting the period of tenure – in the present case, the tenure of a given coach at a Brazilian club – whose probability distribution can be represented by the lifetime distribution function:

$$F(t) = P(T < t) \quad (9)$$

This function indicates that the probability of tenure is less than any given value of t . From formula (9), we can define the relevant first concept, the survival function, which can be defined as:

$$S(t) = P(T \geq t) = 1 - F(t) \quad (10)$$

The survival function gives the probability of a tenure being equal to or greater than any given value of t . In the present case, one could say that the survival function describes the *grade* attributed to the coach, over time (per fixtures in the League).

The second function of interest is the hazard function, given by:

$$\lambda(t) = \frac{f(t)}{S(t)} \quad (11)$$

In this equation, $f(t) = P(T = t)$ is the distribution function in relation to $F(t)$. The hazard function is related, for each tenure, t , to the probability of a fault occurring an infinitesimally short instant after t , conditioned by the fact of the tenure having lasted until that instant.

The hazard and survival functions can be estimated through the use of non-parametric, semiparametric or parametric methods. There are a rising number of hypotheses to be adopted in parametric methods in relation to nonparametric ones, although their explanatory power is also greater, such that the choice of method to be used will depend on the study's aim. For this paper, we chose non-parametric and parametric methodologies, whose main aspects and results will be described below.

3.3 Nonparametric estimation method

Nonparametric methods for the estimation of the hazard and survival functions have been shown to be especially useful due to their simplicity. Furthermore, they represent a strictly empirical approach, with no hypotheses regarding the distributions involved, which could constitute a good alternative as a preliminary analysis of the data. A very popular estimator was proposed by Kaplan and Meier (1958). The nonparametric measure proposed by these authors for the survival function is given by:

$$S(t) = \frac{s_t}{n_t} \quad (12)$$

where s_t represents the number of individuals that, including censored data, survive until the moment t (in other words, last for a period longer than t); and n_t is the surviving population at t , before the change of state occurs.

The survival function resulting from this procedure can be seen in Table 6.2 (see the Appendix). The same evidence can be shown graphically through the use of conditional probabilities, in Figure 2, as a function of the number of survival fixtures.

Figure 2

Nonparametric estimation of the survival function: Kaplan and Meier (1958) method

The results show a uniform behavior for the fall in probability of a given coach surviving until t , conditioned by the fact that he has already been in charge of the team for t fixtures. For example, the conditional probability of survival after five fixtures is 89.3%. After 20 fixtures, this probability falls by approximately 40%. Therefore, the first evidence to be mentioned is the gradual lowering of the probability of retention of coaches, as long as they stay in charge.

3.4 Parametric estimation method

The empirical analysis recently used is very useful, as it brings to light important characteristics of the tenure of coaches in Brazilian soccer, without relying on functional hypotheses regarding distributions associated with the coach's tenure random variable. However, it is necessary to highlight the influence that differences

in certain characteristics of coaches in Brazil can have on the probability of their keeping their jobs, which can be understood by using a parametric methodology.

For this kind of approach, distributional hypotheses should be made to describe the behavior of the conditional probabilities of hazard and survival. There are a large number of probability distributions that are generally used in the literature, such as the Exponential, Weibull and the Log-logistic. For any one of these chosen families of probabilities, specific characteristics are automatically attributed to the hazard and survival functions associated with the tenure random variable.

For example, the hazard function derived from the Exponential distribution is constant over varying tenures. The Weibull distribution is a flexible version of the Exponential distribution in that it allows for variations in the conditional hazard probabilities over the tenure, whereas the Log-logistic distribution allows for non-monotonic behavior of the risk function over varying periods.

To incorporate the effects of the covariant, x , on these hazard functions, we have taken the effects of the explanatory variables directly on the random variable, T , increasing or decreasing the conditional probability of the dismissal of the coaches. This model is known as the *accelerated failure time model*, as the coaches' characteristics act to accelerate (or decelerate) their tenure.¹⁵ The choice of the *accelerated failure-time model* is based on the ease of interpreting the estimated coefficients, as these show, like they do in regular regression equations, the marginal effects of the explanatory variable directly on the random variable T .¹⁶

The results obtained from the adoption of the distinct distributions can be seen in Table 3. With regard to the specific format of each of the distributions, the results, as can be seen, are shown to be robust to the different functional forms.

Firstly, it is important to stress that the regressions were calculated with the presence of variables for tenure and performance of the coaches who were previously in charge. This procedure was adopted to eliminate the effects of the previous management on the work that is being evaluated. However, the included characteristics did not prove to be significant. Furthermore, the dummy for large clubs is insignificant, which shows that the tenure of coaches at large clubs is not different from the tenure of those at smaller ones.

The most important results show the statistical insignificance of the variable for the coach's CV and the significance of the performance variable. In this respect, the coach's tenure seems to be completely related to the performance of the club (under his command) in the League, regardless of the "baggage" he carries. As can be seen, the important attribute of the coach's CV is not statistically relevant, at the usual significance levels, to his ability to stay in charge.¹⁷ Most

¹⁵For a detailed description of this approach, see Kiefer (1988).

¹⁶This effect is seen in the semi-elasticity form: $\ln t = x'\beta + v_t$, where the error term, v_t , follows density, $f(\cdot)$, whose distributional form defines the regression model to be estimated, as well as the respective format for the hazard function.

¹⁷It is, however, possible that the coach's CV is important to reduce his period of unemployment. In other words, even though a coach's CV will not ensure that he will stay in charge, it

Table 3
Parametric Estimation: Accelerated Failure-Time Model (*)

Variable	Distribution		
	Expon.	Log-logistic	Weibull
Performance	0.051 (0.000)	0.041 (0.000)	0.045 (0.000)
Tenure of the previous coach	0.038 (0.103)	-0.001 (0.931)	0.007 (0.650)
Performance of the previous coach	-0.009 (0.312)	-0.004 (0.524)	-0.005 (0.401)
Progress	0.707 (0.014)	0.766 (0.000)	0.608 (0.003)
CV	-0.022 (0.528)	-0.014 (0.582)	-0.016 (0.466)
Large	0.473 (0.426)	0.338 (0.352)	0.450 (0.204)
Number of observations	160	160	160
Wald test	294.35 (0.000)	495.65 (0.000)	528.45 (0.000)

(*) *P*-Values given in brackets. All regressions include year dummies and dummies for each club participating in the Leagues.

of all, the team has to win in order to ensure that a coach remains in charge. In line with Proposition 1, this can be explained by the board's political performance, which maximizes its probability of reelection and thus, when presented with unsatisfactory results, acts by lowering the coach's *grade*.¹⁸

Another interesting result is the longer tenure that is, on average, associated with coaches that take over a given team whilst the League competition is in progress. *Ceteris paribus*, a given coach in this position can expect to have a 1% longer tenure. This evidence could be related to the board having slightly more patience with coaches that are appointed part way through the League, when compared to coaches that began the competition and were therefore privy to a better structure, with the possibility of having indicated players and having been in charge of pre-season matches.

Figure 6.1 (see the Appendix) presents the Cox-Snell residuals (Cox and Snell, 1968) to evaluate the fit of the three parametric specifications. The chart for the functional form of the log-logistic distribution has the best fitting, thus representing the preferred model.¹⁹

can be an important factor in landing him a job when unemployed.

¹⁸The relation between performance and coaches' tenure can be found in the literature. For example, see Frick et al. (2006) and Dobson and Goddard (2001) for references about German and English soccer, respectively.

¹⁹The Cox-Snell residuals are defined by: $\hat{e} = -\log S(t/X, \beta)$, where $S(t/X, \beta)$ is the function of estimated survival. If the estimated model is correct, these residuals should have an exponential distribution with a hazard function equal to 1. Thus, the estimated residuals can be used as

Based on this distribution, one additional exercise was performed. According to Proposition 2, if the board acts based on the model's rationality, the higher the parameter ψ_t , the higher the effect of the performance on the *grade*. This proposition allows us to identify the parameter ψ_t , which gives, literally, the effect of the clubs' performance upon supporters' perception about the board's work. The link can be constructed as follows: If the supporters' perception about the board's work is more strongly dependent on the clubs' performance then, according to Proposition 2, the effect of the performance on the *grade* should be higher.

Likewise, we will perform this identification by classifying clubs according to those in which the *grade* is shown to be more sensitive to the coach's performance. The proposed exercise repeats the regression reported in Table 3 including an interaction of the dummy for clubs and the variable for the coach's performance whilst in charge of the team. This regression can be seen in Table 6.3 (see the Appendix). The coefficients for each club (the sum of the coefficient associated with the performance variable and the interaction between it and the time dummy) are presented in Figure 3.

According to the figure, Vasco, Criciúma, São Paulo, Brasiense and Santos are the clubs in which the coach's *grade* is more strongly dependent on his performance while in charge of the team, and therefore, where the pressure for results is greater. On the other hand, Guarani, Ponte Preta, Vitória, Juventude and Fortaleza are clubs in which the committee's performance least affects their *grade*, in which there is the least pressure for results. To sum up, this shows that in the first group the effect of the clubs' performance on the supporters' perception about the board's work (parameter ψ_t) is higher than in the second group and, therefore, the coaches' tenure in the first group will be more unstable.

In fact, the interpretation of the coefficients reported above as the ψ_t parameter (effect of clubs' performance on supporters' perception) holds if and only if Proposition 2 is valid. To test the relation stated by that proposition we regress (using a standard OLS procedure) the standard deviation of the coaches' tenure in each club (during each year in the sample, 2004 to 2006) against the parameter ψ_t , as calculated above. Proposition 2 suggests a positive relation among these variables. The results are presented in Table 4.

In fact, as one can see the ψ_t parameter positively affects the volatility of coaches' tenure at the clubs. This relation persists even when we control for the number of supporters and for "size" of the clubs – which assumes the value 1 for clubs in the "Big 13". This result supports our findings in Proposition 2.

Finally, it could be interesting to understand the determining factors regarding

the duration variable and have the respective survival function obtained by the Kaplan-Meier method. In this way, the graphical representation of the Cox-Snell residuals and of the additive inverse of the natural logarithm of the respective survival function gives us a notion of the level of fit of the estimated model. The residuals should approach a straight line as much as possible, with a slope equal to 1 and starting from the origin.

Figure 3

Ranking of pressure on coaches. Coefficient associated with performance, by club:
Log-logistic Distribution (*)

(*) All coefficients are significant at 1%, except that for Coritiba, which is significant at 10%. The joint test for the equality of all coefficients is also rejected, which justifies the existence of a ranking among them.

Table 4

Relation between volatility of coaches' tenure and the ψ_t parameter (*)

Variable	Specification	
	Eq. (1)	Eq. (2)
$\ln(\psi_t)$	0.563 (0.025)	0.493 (0.054)
$\ln$ (number of supporters)	-	-0.019 (0.822)
Dummy for large clubs	-	0.075 (0.467)
Constant	4.095 (0.000)	4.011 (0.000)
Number of observations	66	66
R ²	0.097	0.103

(*) P-Values are given in brackets. The standard deviations were calculated using the White matrix. The dependent variable is the $\ln$ of the club's tenure (per year) in each club.

the difference in pressure (ψ_t parameter) among Brazilian clubs. In particular, we estimate an equation that relates a club's political and organizational factors and the pressure exercised by the supporters to the ψ_t parameter, analyzed above. The results are shown in Table 5.

Table 5
Determining factors regarding the ψ_t parameter (*)

Variable	Specification	
	Eq. (1)	Eq. (2)
ln (number of supporters)	0.081 (0.219)	0.024 (0.694)
Dummy for large clubs	-	0.214 (0.000)
Constant	-3.916 (0.000)	-3.350 (0.000)
Number of observations	66	66
R ²	0.031	0.228

(*) *P*-Values are given in brackets. The standard deviations were calculated using the White matrix. The dependent variable is the ln of the coefficients shown in Tale 6.3.

The estimation indicates that a club's political and organizational factors (approximated by the dummy variable for large clubs) are important factors in explaining the effect of the club's performance upon supporters' perception – and therefore the pressure imposed by the board on its coach. Finally, the average number of people watching the club's match for the 2004, 2005 and 2006 Leagues also failed to be significant for any of the specifications tested.

4. Final Considerations

In line with recent efforts to introduce economic theory to study Brazilian soccer (see Giovannetti et al., 2006), in this paper, we constructed a theoretical model to explain the tenure of coaches at Brazilian clubs. According to the model, a club's board maximizes its chances of reelection and, during the Brazilian National Soccer League, if we consider the club's roster as a quasi-fixed input, the only control mechanism available to the board is precisely the trust (*grade*) it attributes to its technical committee. The model's solution reveals that the performance of the team is fundamental in explaining the trust the board places in its technical committee. Poor performances lead the board to reduce its trust in the technical committee, thus minimizing the effects of poor performance on the board's reputation, which, in turn, makes it harder for a coach to remain in charge at the club. Furthermore, the model postulates that coaches of clubs with more

fanatical (or better organized) supporters, or those with more aggressive opposing parties, will experience these effects more sharply.

We then proceeded to put these propositions to empirical analysis based on data from the Brazilian National Soccer League and duration analysis techniques. In particular, we used the tenure of coaches as a proxy for the trust (*grade*) that a board attributes to the technical committee. According to the results obtained, it was possible to conclude, in line with the theoretical model's predictions, that the most important factor in determining the tenure of a coach is precisely his performance whilst in charge of his team.

This model allows us to identify a parameter that literally gives the effect of the clubs' performance upon supporters' perception about the board's work. The link can be constructed as follows: If the supporters' perception about the board's work is more strongly dependent on the clubs' performance then the effect of the performance on the *grade* should be higher.

Finally, we showed that these differences in levels of pressure that the supporters impose on the board, and therefore, that the board imposes upon its coaches, are further explained by a club's internal policies (and organizational) aspects than by actions from its supporters.

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Appendix

Table 6.1
Tenure of coaches at Brazilian clubs

Tenure of coaches	Frequency	(%)	Cumulative
2	4	2.50	2.50
3	5	3.13	5.63
4	5	3.13	8.75
5	5	3.13	11.88
6	6	3.75	15.63
7	4	2.50	18.13
8	11	6.88	25.00
9	8	5.00	30.00
10	4	2.50	32.50
11	12	7.50	40.00
12	9	5.63	45.63
13	10	6.25	51.88
14	4	2.50	54.38
15	2	1.25	55.63
16	9	5.63	61.25
17	4	2.50	63.75
18	3	1.88	65.63
19	6	3.75	69.38
20	1	0.63	70.00
21	3	1.88	71.88
22	5	3.13	75.00
23	4	2.50	77.50
24	4	2.50	80.00
25	1	0.63	80.63
26	1	0.63	81.25
27	1	0.63	81.88
28	5	3.13	85.00
29	1	0.63	85.63
30	1	0.63	86.25
31	1	0.63	86.88
32	4	2.50	89.38
38	6	3.75	93.13
39	2	1.25	94.38
40	1	0.63	95.00
41	2	1.25	96.25
42	1	0.63	96.88
43	1	0.63	97.50
45	1	0.63	98.13
46	3	1.88	100.00
Total	160	100.00	

Table 6.2

Nonparametric estimation of the Survival Function: Kaplan and Meier (1958) method

Tenure of coaches	Total	Fail	Net lost	Survival function	Std. error
2	160	4	0	0.975	0.0123
3	156	4	1	0.950	0.0172
4	151	5	0	0.9185	0.0217
5	146	4	1	0.8934	0.0244
6	141	5	1	0.8617	0.0274
7	135	4	0	0.8362	0.0294
8	131	7	4	0.7915	0.0323
9	120	6	2	0.7519	0.0345
10	112	3	1	0.7318	0.0355
11	108	9	3	0.6708	0.0379
12	96	8	1	0.6149	0.0396
13	87	8	2	0.5583	0.0407
14	77	2	2	0.5438	0.0409
15	73	1	1	0.5364	0.041
16	71	8	1	0.476	0.0416
17	62	4	0	0.4453	0.0416
18	58	0	3	0.4453	0.0416
19	55	4	2	0.4129	0.0416
20	49	1	0	0.4044	0.0416
21	48	2	1	0.3876	0.0416
22	45	0	5	0.3876	0.0416
23	40	4	0	0.3488	0.0417
24	36	3	1	0.3198	0.0414
25	32	0	1	0.3198	0.0414
26	31	0	1	0.3198	0.0414
27	30	0	1	0.3198	0.0414
28	29	3	2	0.2867	0.0413
29	24	1	0	0.2747	0.0413
30	23	0	1	0.2747	0.0413
31	22	0	1	0.2747	0.0413
32	21	1	3	0.2617	0.0413
38	17	0	6	0.2617	0.0413
39	11	0	2	0.2617	0.0413
40	9	0	1	0.2617	0.0413
41	8	0	2	0.2617	0.0413
42	6	0	1	0.2617	0.0413
43	5	0	1	0.2617	0.0413
45	4	1	0	0.1962	0.0646
46	3	0	3	0.1962	0.0646

Table 6.3
Parametric Estimation: Accelerated Failure-Time Model (*)

Variable	Log-logistic distribution	
	Coefficient	P-value
Performance of the previous coach	-0.003	0.844
Performance	0.049	0.000
Tenure of the previous coach	-0.003	0.640
In Progress	0.717	0.000
CV	-0.019	0.382
Large	-0.251	0.336
Club		
Atlético-MG	-	-
Atlético-PR	-0.00292	0.795
Botafogo	-0.00951	0.444
Brasiliense	0.00415	0.725
Corinthians	-0.01006	0.347
Coritiba	-0.00691	0.792
Criciúma	0.00712	0.505
Cruzeiro	-0.00809	0.397
Figueirense	-0.00922	0.518
Flamengo	-0.00763	0.494
Fluminense	-0.00394	0.697
Fortaleza	-0.01591	0.158
Goiás	-0.01490	0.367
Grêmio	-0.00218	0.852
Guarani	-0.02544	0.028
Internacional	-0.00015	0.990
Juventude	-0.01803	0.175
Palmeiras	-0.00725	0.433
Paraná	-0.00296	0.795
Paysandu	-0.00942	0.405
Ponte Preta	-0.02434	0.032
Santa Cruz	-0.00974	0.576
Santos	0.00406	0.776
São Caetano	-0.002185	0.061
São Paulo	0.00639	0.548
Vasco	0.02361	0.007
Vitória	-0.01901	0.078
Number of Observations	160	
Wald test	514.69	

(*)P-Value given in brackets. All regressions include year dummies and dummies for each club participating in the Leagues.

Figure 6.1 – Cox-Snell residuals to evaluate the fit of the parametric models: Exponential, Log-logistic and Weibull distributions